

# California Education and the Environment Initiative

Increasing Environmental Literacy for K–12 Students...

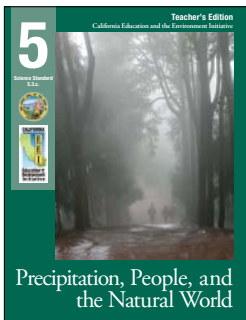
Because the Future is in Their Hands



## TEACH COMMON CORE STANDARDS WITH THE EEI CURRICULUM

Created with your needs in mind, this document shows the correlation between the EEI Curriculum and the California Common Core State Standards. By teaching the EEI unit lessons in your classroom, you will be simultaneously addressing the Common Core standards depicted in this guide.

### 5.3.c.—Precipitation, People, and the Natural World



In this unit, students gain a deep understanding of precipitation and its importance in California. Students learn about California's natural precipitation patterns and the variety of ecosystems that depend on precipitation to function naturally. Students connect precipitation to the vitality of California's important agriculture industry. They discover what happens when aquatic plants and chalk are put in acidified water and examine evidence about historical amounts of precipitation around cities.

LESSONS	COMMON CORE STANDARDS															
	California Connections	RI.5.1	RI.5.3	RI.5.4	RI.5.7	RI.5.10	W.5.2	W.5.8	W.5.9	SL.5.1	SL.5.2	SL.5.3	SL.5.4	SL.5.5	L.5.4	L.5.6
	1	✓	✓	✓	✓	✓	✓	✓		✓	✓				✓	✓
	2			✓	✓		✓	✓			✓	✓			✓	
	3		✓	✓	✓		✓		✓	✓					✓	
	4	✓	✓	✓	✓			✓	✓	✓			✓	✓	✓	
	5			✓		✓	✓	✓		✓		✓			✓	
	6		✓	✓	✓	✓	✓	✓				✓			✓	
	Traditional Assessment						✓									
	Alternative Assessment						✓						✓	✓		

**Note:** For your reference, the list of California Common Core State Standards abbreviations is on the following page.

## Using the EEI-Common Core Correlation Matrix

The matrix on the front page identifies a number of Common Core standards that are supported by this EEI unit. However, the check marks in the matrix do not necessarily signify that the Common Core standards checked will be taught to mastery by using this EEI unit alone. Teachers are encouraged to select which Common Core standards they wish to emphasize, rather than teaching to every indicated standard. By spending more time on selected standards, students will move toward greater Common Core proficiency in comprehension, critical thinking and making reasoned arguments from evidence. Teaching this EEI unit will provide opportunities for teachers to implement the shift in instructional practice necessary for full Common Core implementation.

## California Common Core State Standards Abbreviations

- **CCCSS:** California Common Core State Standards
- **L:** Language Standards
- **RI:** Reading Standards for Informational Text
- **SL:** Speaking and Listening Standards
- **W:** Writing Standards

**Note:** Since each Common Core standard includes a breadth of skills, in this correlation, the portion of the standard description that is featured in the Common Core Standards and Applications is cited, using “...” to indicate omitted phrases. For a list of the complete standard descriptions, please see the Common Core Reference Pages located on page 26 of this document.

## A Note about Common Core Speaking and Listening Standards

Many of the EEI units provide various learning structures, materials, and groupings that lead toward students working in pairs or small groups to discuss concepts and ideas. This supports the skill in Speaking and Listening Standard 1 “Participate effectively in a range of collaborative discussions (one-on-one, groups...) with diverse partners.” With prior instruction in collaborative discussion techniques, students can be placed in pairs or small groups to discuss the lesson topics. To aid in teacher planning, the lessons are listed below along with their learning structures for whole class, pairs/partners, and/or small groups:

- **Lesson 1:** Whole class, groups of 4, partners (optional)
- **Lesson 2:** Whole class, partners (optional)
- **Lesson 3:** Whole class, partners (optional), groups of 3
- **Lesson 4:** Whole class, small groups
- **Lesson 5:** Whole class, groups of 4
- **Lesson 6:** Whole class, partners (optional)

## National Geographic Resources

- **Natural Regions** wall map (Lessons 1, 2, and 3)
- **Political** wall map (Lessons 1 and 3)

## Unit Assessment Options

Assessments	Common Core Standards and Applications
<b>Traditional Assessment</b>	
The traditional assessment is comprised of multiple-choice, matching, and short-answer questions that assess students' achievement of the unit's learning objectives.	<b>W.5.2b:</b> Develop the topic with facts, definitions, concrete details,...or other information and examples...
<b>Alternative Assessment</b>	
<p>The alternative assessment has students write a newspaper article, pamphlet, or radio script to educate the public about the importance of water in California.</p> <p><b>Tip:</b> <i>The product can be constructed manually or digitally.</i></p>	<p><b>SL.5.4:</b> Report on a topic..., sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.</p> <p><b>SL.5.5:</b> Include multimedia components (e.g., graphics, sound) and visual displays in presentations...</p> <p><b>W.5.2d:</b> Use precise language and...vocabulary to inform...</p>

Students hear about snowpack measurements in the Sierra Nevada and discover the importance of the snowpack to California. They use photographs to identify different types of precipitation and chart when and where different forms of precipitation are likely to fall.



- **Natural Regions** wall map
- **Political** wall map

Procedures	Common Core Standards and Applications
<b>Vocabulary Development</b>	
<p>Use the <b>Dictionary</b> and the vocabulary <b>Word Wall Cards</b> to introduce new words to students as appropriate. These documents are provided separately.</p> <p><b>Tip:</b> If <b>Dictionary Workbooks</b> need to be reused from year to year, students should not write in them.</p>	<p><b>L.5.4c:</b> Consult reference materials...to...determine or clarify the precise meaning of key words and phrases...</p> <p><b>RI.5.4:</b> Determine the meaning of general academic and domain-specific words and phrases in a text...</p>
<b>Step 1</b>	
<p>Distribute a <b>Student Workbook</b> to each student. Tell them to turn to <b>California California Connections: The Sierra Snowpack</b> (Student Workbook, pages 2–5). Have students read the story silently. Use the following questions to guide a class discussion about the article. Make sure students understand the importance of the Sierra snowpack to mountain plants and animals, as well as to human communities throughout California:</p> <ul style="list-style-type: none"> <li>■ Why is the snowpack called a solid reservoir? (<i>It is a solid reservoir because it stores water in the mountains in the form of snow, which is a solid. Starting in the spring and through the early summer, the snow gradually melts and replenishes the water supply in human-made reservoirs and groundwater aquifers.</i>)</li> <li>■ How do you depend on the snowpack in the Sierra Nevada? (<i>The snowpack supplies two-thirds of the state's water. The entire economy of the state depends on the water in snowpack because it fuels the important agriculture industry, as well as many other industries. Without water in our homes, we would not be able to do things like take a drink of water, wash, cook, or water our gardens. Snowpack is also essential for the ski industry. Electricity can be produced by water that is released through dams.</i>)</li> <li>■ Why may California's snowpack be at risk? (<i>Scientific research shows Earth's temperature is rising. Warmer air causes snow to melt earlier in the spring, or not to fall at all.</i>)</li> </ul>	<p><b>RI.5.1:</b> Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.</p> <p><b>RI.5.10:</b> ...read and comprehend informational texts, including...science...texts...</p> <p><b>SL.5.1c:</b> Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.</p> <p><b>Suggestion:</b> Teachers can choose which medium students use to answer the questions: whole class, orally, with partners, in writing, on the computer, etc.</p> <p><b>W.5.2d:</b> Use precise language and domain-specific vocabulary to inform about or explain the topic.</p> <p><b>W.5.8:</b> Recall relevant information from experiences or... from print and digital sources; summarize or paraphrase information in notes and finished work...</p>

Procedures	Common Core Standards and Applications
<b>Step 1 (Continued):</b>	
<p><b>Tip:</b> If <b>Student Workbooks</b> need to be reused from year to year, students should not write in them. Some strategies teachers use to preserve the workbooks are:</p> <ul style="list-style-type: none"> <li>■ Have students use binder paper or other lined or unlined paper</li> <li>■ Have students use a sheet protector over the page and write with a whiteboard marker</li> <li>■ Do together as a class on a projector or chart paper</li> <li>■ Project the digital fill-in version and do together as a class</li> <li>■ Students use digital devices to fill in the digital version found on the website</li> <li>■ Make student copies when necessary</li> </ul>	<p><b>RI.5.1:</b> Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.</p> <p><b>RI.5.10:</b> ...read and comprehend informational texts, including...science...texts...</p> <p><b>SL.5.1c:</b> Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.</p> <p><b>W.5.2d:</b> Use precise language and domain-specific vocabulary to inform about or explain the topic.</p> <p><b>W.5.8:</b> Recall relevant information from experiences or... from print and digital sources; summarize or paraphrase information in notes and finished work...</p>
<b>Step 2</b>	
<p>Project <b>Measuring Snowpack</b> (Visual Aid #1). Explain that once each month, snow surveyors ski to each of the stations that make up a course. They take two important measurements at each station: the depth of the snow and the weight or density of the snow sample. To do this, they carry hollow aluminum tubes and a balance with them. To measure the depth of the snow, they plunge the aluminum tube into the snow until it hits ground. Then they pull up the tube, which has filled with snow, and measure the weight of the snow in the tube.</p> <p><b>Tip:</b> Refer to the <b>Extensions and Unit Resources</b> on page 30 of the <i>Teacher's Manual</i> for websites about snow pack.</p>	n/a
<b>Step 3</b>	
<p>Project <b>Pika</b> (Visual Aid #2). Use the following questions to conduct a class discussion:</p> <ul style="list-style-type: none"> <li>■ Why is snowpack important to animals in the Sierra Nevada? (<i>Many native animals are dependent on a snowy alpine habitat. Many mammals, such as the pika, rely on the protective cover that snow provides them in severe cold.</i>)</li> <li>■ Why are alpine animals in the Sierra Nevada threatened? (<i>Their habitat is disappearing. As the climate in the Sierra Nevada warms, animals like the pika are forced to retreat higher up into the mountains. Because pikas cannot survive in warmer climates, they cannot cross warm valleys to get to other mountains. That is why they are struggling to find new homes.</i>) Explain that pikas may be only one of many alpine creatures that may lose their habitat because of global climate change. Scientists estimate that the pika population has decreased by 10% to 35% in the last 10 years. The animals have moved 1,700 feet higher in elevation in the last 90 years, and they are still retreating up mountain slopes.</li> </ul>	<p><b>SL.5.1c:</b> ...respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.</p> <p><b>W.5.8:</b> Recall relevant information from experiences...or... from print and digital sources; summarize or paraphrase information in notes and finished work...</p>

Procedures	Common Core Standards and Applications
<b>Step 3 (Continued):</b>	
<ul style="list-style-type: none"> <li>Why is it important to pay attention to what is happening to the pika? (<i>What is happening to them is telling us something about the climatic changes in the Sierra Nevada. It may indicate the effects that climate change could have on other species, including humans.</i>)</li> </ul> <p><b>Tip:</b> Teachers may want to bring in more information from different sources about the pika, or allow the students to do some research on their own.</p>	<p><b>SL.5.1c:</b> ...respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.</p> <p><b>W.5.8:</b> Recall relevant information from experiences...or... from print and digital sources; summarize or paraphrase information in notes and finished work...</p>
<b>Step 4</b>	
<p>Project <b>The Water Cycle</b> (Visual Aid #3). Explain to students this unit focuses on the part of the water cycle called precipitation. Use the following questions to conduct a class discussion:</p> <ul style="list-style-type: none"> <li>What is precipitation? (<i>Water that falls from clouds to Earth as rain, mist, hail, sleet, ice, or snow.</i>)</li> <li>How does precipitation form? (<i>Water vapor in the atmosphere condenses to form tiny droplets in clouds. Once the droplets grow too big for air currents to hold them up, gravity causes them to fall as precipitation.</i>)</li> <li>What happens to precipitation after it falls to the ground? (<i>The precipitation eventually seeps into the ground or runs off into streams and rivers.</i>)</li> </ul>	<p><b>L.5.6:</b> Acquire and use accurately grade-appropriate...domain-specific words and phrases...</p> <p><b>RI.5.4:</b> Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a <i>grade 5 topic or subject area</i>...</p> <p><b>SL.5.2:</b> Summarize...information presented in diverse media and formats, including visually, quantitatively, and orally.</p> <p><b>W.5.8:</b> Recall relevant information from experiences or gather relevant information from print and digital sources...</p> <p><b>Suggestion:</b> Students can discuss answers with a partner before sharing out to the whole class.</p>
<b>Step 5</b>	
<p>Display <b>Types of Precipitation</b> (Information Cards #1–5), covering up the name of each form of precipitation with a sticky note. Organize students into groups of four. Ask each group to identify the forms of precipitation in the five photographs. Have groups use their <b>Dictionary</b> to help them find the correct vocabulary to describe each picture. Review the definitions of each type of precipitation (<i>Rain, snow, freezing rain, sleet, and hail</i>) by reading the posted <b>Word Wall Cards</b>.</p> <p><b>Tip:</b> If <b>Dictionary Workbooks</b> need to be reused from year to year, students should not write in them.</p>	<p><b>L.5.6:</b> Acquire and use accurately grade-appropriate...domain-specific words and phrases...</p> <p><b>RI.5.4:</b> Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a <i>grade 5 topic or subject area</i>...</p> <p><b>W.5.8:</b> Recall relevant information from experiences...</p>
<b>Step 6</b>	
<p>Project <b>When and Where Precipitation Falls in California</b> (Visual Aid #4). As a class, fill in the chart to review when and where different forms of precipitation occur in California. (<i>Note: An Answer Key and Sample Answers for <b>When and Where Precipitation Falls in California</b> are provided on page 39.</i>)</p>	<p><b>R.5.3:</b> Explain the relationships or interactions between two or more...ideas, or concepts in a...scientific...text based on specific information...</p>
<b>Step 7</b>	
<p>Point out your community on the <b>Natural Regions</b> wall map. (<i>Note: If necessary, you can reference the <b>Political</b> wall map to find your location.</i>) Ask the following questions to prompt class discussion about precipitation in California.</p> <ul style="list-style-type: none"> <li>What kinds of precipitation do we have in our area? (<i>Answers depend on location.</i>)</li> </ul>	<p><b>RI.5.7:</b> Draw on information from multiple...sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.</p> <p><b>Suggestion:</b> Students can discuss answers to questions with their small group before sharing them whole class.</p>

Procedures	Common Core Standards and Applications
<b>Step 7 (Continued):</b>	
<ul style="list-style-type: none"> <li>■ How does precipitation in our area change from one season to another? <i>(Answers will vary, depending on location. In areas where temperatures reach below freezing, snow, freezing rain, and sleet can occur during the winter months. Rain occurs in most parts of California when temperatures are above freezing, primarily from late fall to early spring. Hail occurs during thunderstorms, which can happen in California throughout the year.)</i></li> <li>■ Point out the Sierra Nevada and the Coast Ranges on the <b>Natural Regions</b> wall map. Ask students, “What types of precipitation fall in the mountains in California during the winter?” <i>(Snow falls in the mountains in winter. Freezing rain and sleet might also fall in this area.)</i></li> <li>■ Point out the Central Valley and the Mojave Desert on the <b>Natural Regions</b> wall map. Ask students, “How cold does it get in winter at lower elevations, such as in the Central Valley and in the Mojave Desert?” <i>(Temperatures are cooler, but generally stay above freezing.)</i></li> <li>■ During the winter, what types of precipitation fall in the Central Valley and in the Mojave Desert? <i>(Most of that precipitation is rain. Snow is extremely rare because temperatures stay above freezing, even in winter.)</i></li> <li>■ When and where do thunderstorms occur in California? <i>(Thunderstorms can occur anywhere in California. Typically, thunderstorms develop along the Sierra Nevada in the late summer and early autumn. Also, thunderstorms move through the southern part of the state in winter.)</i></li> </ul>	<p><b>SL.5.1:</b> Engage effectively in a range of collaborative discussions...</p> <p>c) ...respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.</p> <p>d) Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussion.</p> <p><b>W.5.8:</b> Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work...</p>
<b>Step 8</b>	
<p>Tell students to turn to <b>Precipitation in California</b> (Student Workbook, pages 6–7). Instruct students to complete <b>Precipitation in California</b> in class or as homework.</p> <p>Collect <b>Student Workbooks</b> and use <b>Precipitation in California</b> for assessment.</p>	<p><b>W.5.2:</b> Write informative/explanatory texts to examine a topic and convey ideas and information clearly.</p> <p>b) Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic.</p>

## Lesson 2: How Clouds Form in California

Students watch clouds form in bottles and discover that three things are needed for cloud formation. Using discussions, a map, and diagrams, students learn how and where fog and clouds usually occur in California, and how mountains influence the process.



## National Geographic Resources

- **Natural Regions** wall map

Use this correlation in place of the **Procedures** on pages 58–60 of the Teacher's Edition.

Procedures	Common Core Standards and Applications
<b>Vocabulary Development</b>	
Use the <b>Dictionary</b> and the vocabulary <b>Word Wall Cards</b> to introduce new words to students as appropriate.	<p><b>L.5.4c:</b> Consult reference materials...to...determine or clarify the precise meaning of key words and phrases...</p> <p><b>RI.5.4:</b> Determine the meaning of general academic and domain-specific words and phrases in a text...</p>
<b>Step 1</b>	
<p>Tell students that you are going to do a demonstration of how clouds form. Perform the following cloud formation demonstration, while explaining what you are doing:</p> <ul style="list-style-type: none"> <li>■ Pour about one-half cup of hot water into each jar.</li> <li>■ Twist a 3" x 3" sheet of newspaper to make a small torch and set it on fire. (An alternative approach to "make it rain" in the classroom is to use an electric tea pot, hold a bag or clear bowl over the steaming spout capturing the water vapor; eventually it condenses at the top of the bowl forming water droplets that will then fall.) (<i>Note: Caution students not to try this at home without adult supervision.</i>)</li> <li>■ Drop the burning paper into just one of the two jars.</li> <li>■ Cover the top of each jar with a plastic bag. Place three ice cubes in each bag, so the ice inside the bag hangs into the jar. Secure the bag with a rubber band.</li> <li>■ Ask students to observe what is happening inside both jars. Darken the room and shine a light into the jars. (<i>Tiny water droplets forming inside the jar with smoke. No droplets in the other jar.</i>)</li> <li>■ Ask students to describe what they observe in each jar. (<i>In the jar with smoke, tiny water droplets are swirling around and sinking down in the jar. Nothing is changing in the jar without the smoke.</i>)</li> </ul>	<p><b>SL.5.2:</b> Summarize...information presented in diverse media and formats, including visually...and orally.</p> <p><b>SL.5.3:</b> Summarize the points a speaker...makes and explain how each claim is supported by reasons and evidence...</p> <p><b>W.5.8:</b> Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work...</p> <p><b>Suggestion:</b> <i>Students could take notes on the observations that they, and other students, made.</i></p>

Procedures	Common Core Standards and Applications
<b>Step 2</b>	
<p>Project <b>Three Things Needed for Cloud Formation</b> (Visual Aid #5). Explain that the first thing needed to form clouds is water vapor, which is water in the form of an invisible gas in the air. Use the vocabulary <b>Word Wall Cards</b> to review the definition of the word “evaporation.” To explore this first element of cloud formation, ask the following questions:</p> <ul style="list-style-type: none"> <li>■ In our demonstration, where did we get the water vapor required to make the cloud? <i>(The hot water in the jar evaporated quickly, filling the jar with water vapor.)</i></li> <li>■ Would there be more water vapor in the air over a desert or over the ocean? <i>(There would be more over an ocean, because lots of water vapor can escape into the air from the surface of an ocean; a desert has less water to evaporate into the air.)</i></li> </ul>	<p><b>RI.5.7:</b> Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem.</p> <p><b>W.5.8:</b> Recall relevant information from experiences...</p>
<b>Step 3</b>	
<p>Explain that the second thing needed for clouds to form is for the temperature to drop to the dew point. Explain that dew point is the temperature at which water vapor in the air condenses. Use the vocabulary <b>Word Wall Cards</b> to review the definitions of “condensation” and “dew point.” To explore this second element of cloud formation, ask the following questions:</p> <ul style="list-style-type: none"> <li>■ What happened in our experiment that caused the air in the jar to cool so the vapor condensed? <i>(We put ice on top of the jars. The ice cooled the air to the dew point.)</i></li> <li>■ Where did we see evidence of condensation in each jar? <i>(There was condensation in the cloud within one jar and also on the sides of the other jar.)</i></li> <li>■ Why do water droplets form on the outside of a glass on a hot, humid day? <i>(Water vapor in the air hits the cold surface of the glass. It is cooled to the dew point and condenses.)</i></li> </ul>	<p><b>RI.5.7:</b> Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem.</p> <p><b>W.5.8:</b> Recall relevant information from experiences...</p>
<b>Step 4</b>	
<p>Explain that the third thing needed for clouds to form is aerosols. Use the vocabulary <b>Word Wall Card</b> to review the definition of “aerosol.” Aerosols provide surfaces on which water vapor in the air can condense to form clouds. Explain that aerosols can have natural origins or can come from human activities. To explore cloud formation, ask students:</p> <ul style="list-style-type: none"> <li>■ In our experiment, where did we get the aerosols needed for cloud formation? <i>(The aerosols arose from the smoke from the burning paper.)</i></li> <li>■ How is the outside surface of a glass of cold water similar to the smoke particles? <i>(Both provide surfaces on which water can condense.)</i></li> <li>■ If there were no aerosols in the air, would clouds form? <i>(No, because water vapor needs surfaces on which to condense into water droplets.)</i></li> </ul>	<p><b>L.5.4c:</b> Consult reference materials...to...determine or clarify the precise meaning of key words and phrases...</p> <p><b>RI.5.7:</b> Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem.</p> <p><b>W.5.8:</b> Recall relevant information from experiences...</p>

Procedures	Common Core Standards and Applications
<b>Step 4 (Continued):</b>	
<ul style="list-style-type: none"> <li>■ What might be some natural sources of aerosols? (<i>Some of the sources include sea salt from sea spray and waves; dust from dry, bare soil; ash from erupting volcanoes; pollen from plants.</i>)</li> <li>■ What human activities might produce aerosols? (<i>We can produce smoke particles by burning fossil fuels, burning other materials, or by performing road construction, which raises dust.</i>)</li> <li>■ Why did a cloud form in the container with smoke, but not in the other container? (<i>The smoke particles provided a surface on which the water vapor could condense. The water vapor in the other container condensed on the sides of the container, because no smoke particles were present.</i>)</li> </ul>	<p><b>L.5.4c:</b> Consult reference materials...to...determine or clarify the precise meaning of key words and phrases...</p> <p><b>RI.5.7:</b> Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem.</p> <p><b>W.5.8:</b> Recall relevant information from experiences...</p>
<b>Step 5</b>	
<p>Ask students to define the word “fog.” Compare their definition to that on the vocabulary <b>Word Wall Cards</b>. Explain that fog forms when humid air near the ground is cooled to the dew point. Project <b>Fog on the California Coast</b> (Visual Aid #6). Use the <b>Natural Regions</b> wall map to point out how close California is to the Pacific Ocean. Explain that air over the ocean picks up water vapor and is relatively warm and moist. Fog is common along the California coast because cold water near the coast cools the air, causing the water vapor to condense. Explain that many plants on the California coast rely on coastal fog as a source of water, especially during dry, summer months.</p>	<p><b>L.5.4c:</b> Consult reference materials...to...determine or clarify the precise meaning of key words and phrases...</p>
<b>Step 6</b>	
<p>Explain that in California, most clouds form at higher elevations. Ask students, “When you go up into the mountains, is it generally warmer or cooler than at lower elevations?” (Cooler) Remind students that as moist air moves upward, it cools. Once it cools to the dew point, water vapor condenses on aerosols to form clouds.</p> <p>On the <b>Natural Regions</b> wall map, point out a few major geographic features, including mountain ranges, such as the Coast Ranges and the Sierra Nevada, the Central Valley, and the Mojave Desert and Sonoran Desert. Explain that the wind in California usually blows from west to east from the Pacific Ocean into California. Ask the following questions:</p> <ul style="list-style-type: none"> <li>■ Is the air over the ocean moist or dry? (<i>It is moist because water vapor enters the air from the ocean.</i>)</li> <li>■ What happens when moist air from over the Pacific blows into California? (<i>The moist air hits the Coast Ranges and is forced upward.</i>)</li> <li>■ What happens when moist air rises? (<i>The air cools, water vapor condenses, and clouds form.</i>)</li> <li>■ On which side of the mountains do the clouds form? (<i>They form on the side the wind is coming from, so they form on the west side.</i>)</li> </ul>	<p><b>SL.5.2:</b> Summarize...information presented...orally.</p> <p><b>Suggestion:</b> <i>At the end of the questions, students can summarize, individually or with a partner, the information given through the questions for a better understanding of the prerequisites of the rainshadow effect.</i></p>

Procedures	Common Core Standards and Applications
<b>Step 6 (Continued):</b>	
<ul style="list-style-type: none"> <li>■ What often happens when clouds form? (<i>It rains or snows.</i>)</li> <li>■ Explain that as the air continues to move from west to east across California. It comes down the eastern side of the Coast Ranges, warming as it descends, then moves across the Central Valley. Ask students, “What do you think happens when the air hits the Sierra Nevada?” (<i>The air moves up again, cools and condenses, and clouds form on the western side of the mountains.</i>)</li> </ul> <p><b>Tip:</b> A picture or diagram of the questions would help students picture what is happening throughout the formation of the cloud.</p>	<p><b>SL.5.2:</b> Summarize...information presented...orally.</p>
<b>Step 7</b>	
<p>Project <b>The Rainshadow Effect</b> (Visual Aid #7). Use the diagram to illustrate the following questions:</p> <ul style="list-style-type: none"> <li>■ If clouds form and precipitation falls on the western sides of the mountains, what do you think the eastern slopes are like? (<i>They are drier.</i>)</li> <li>■ Does the air get warmer or cooler when it descends on the eastern (leeward) side of the mountain? (<i>It gets warmer as it descends.</i>)</li> <li>■ Which can hold more water vapor, warmer or cooler air? (<i>Warmer air can hold more water vapor.</i>)</li> </ul> <p>Why are there very few clouds and little precipitation on the leeward side of the mountain? (<i>The first reason is that water vapor has left the air and has fallen as precipitation on the windward side of the mountain. The second reason is that as the air descends on the leeward side, it gets warmer, so it can hold more water vapor; thus fewer clouds form.</i>) Explain that this is called the rainshadow effect. Use the vocabulary <b>Word Wall Cards</b> to define the rainshadow effect.</p>	<p><b>L.5.4c:</b> Consult reference materials...to...determine or clarify the precise meaning of key words and phrases...</p> <p><b>RI.5.7:</b> Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.</p>
<b>Step 8</b>	
<p>Redistribute students’ individual <b>Student Workbooks</b>. Tell them to turn to <b>How Clouds Form in California</b> (Student Workbook, pages 8–9).</p> <p>Instruct students to complete <b>How Clouds Form in California</b> in class or as homework.</p> <p>Collect <b>Student Workbooks</b> and use <b>How Clouds Form in California</b> for assessment.</p>	<p><b>W.5.2:</b> Write informative/explanatory texts...</p> <p>b) Develop the topic with facts, definitions, concrete details, ...or other information and examples related to the topic.</p> <p>d) Use precise language and domain-specific vocabulary to inform about or explain the topic.</p>

## Lesson 3: Precipitation and Terrestrial Ecosystems

Students compare a precipitation map to a map of natural regions in California and discover that precipitation patterns strongly influence the distribution of natural regions. They read maps and answer questions about precipitation and how it shapes natural systems.



## National Geographic Resources

- **Natural Regions** wall map
- **Political** wall map

Use this correlation in place of the **Procedures** on pages 72–73 of the Teacher’s Edition.

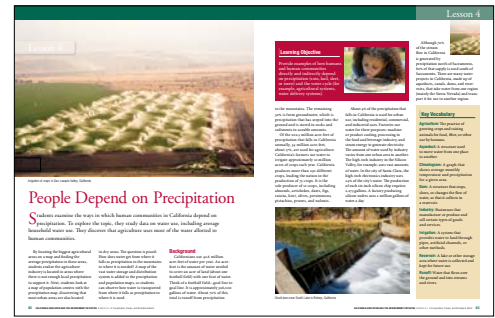
Procedures	Common Core Standards and Applications
<b>Vocabulary Development</b>	
Use the <b>Dictionary</b> and the vocabulary <b>Word Wall Cards</b> to introduce new words to students as appropriate.	<p><b>L.5.4c:</b> Consult reference materials...to...determine or clarify the precise meaning of key words and phrases...</p> <p><b>RI.5.4:</b> Determine the meaning of general academic and domain-specific words and phrases in a text...</p>
<b>Step 1</b>	
On the <b>Political</b> wall map, draw a line with your finger from Santa Cruz to Bishop. Tell students to imagine a giant knife slicing into the ground along this line, cutting a giant slice out of California from Bishop to Santa Cruz. You would have a cross section of the state along an east-west line. Project <b>How Mountains in California Influence Precipitation</b> (Visual Aid #8). The top diagram shows how elevation changes along the cross section. Point out the graph below the diagram. It shows annual precipitation data for different locations along the same line. Ask students, “What does the graph tell you about elevation effects on the amount of precipitation an area receives?” ( <i>The graph shows that higher elevation areas get more rain than areas in the mountains’ rainshadow.</i> )	<p><b>RI.5.3:</b> Explain the relationships or interactions between two or more...ideas, or concepts in a...scientific...text...</p> <p><b>RI.5.7:</b> Draw on information from...print...sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.</p>
<b>Step 2</b>	
Project <b>Giant Sequoia in Yosemite National Park</b> and <b>Desert Plants in Bishop</b> (Visual Aids #9–10). Point out the locations of Yosemite and Bishop on <b>How Mountains in California Influence Precipitation</b> . Ask the following questions: <ul style="list-style-type: none"> <li>■ Why do you think giant sequoias grow in Yosemite? (<i>These trees need lots of water. Precipitation of about 100 centimeters [approximately 39.4 inches] per year can support the growth of these giant trees.</i>)</li> </ul>	<p><b>RI.5.3:</b> Explain the relationships or interactions between two or more...ideas, or concepts in a...scientific...text...</p> <p><b>SL.5.1d:</b> Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions.</p>

Procedures	Common Core Standards and Applications
<b>Step 2 (Continued):</b>	
<ul style="list-style-type: none"> <li>■ Why do shrub-like plants grow in Bishop? (<i>They are adapted to low rainfall. They do not need much rain to grow.</i>)</li> <li>■ What do you think would happen if you planted a giant sequoia in Bishop? Would it grow there? (<i>No, because it would not get adequate precipitation.</i>)</li> </ul>	<p><b>RI.5.3:</b> Explain the relationships or interactions between two or more...ideas, or concepts in a...scientific...text...</p> <p><b>SL.5.1d:</b> Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions.</p>
<b>Step 3</b>	
<p>Project <b>Average Annual Precipitation in California</b> (Visual Aid #11) and have students compare it to the <b>Natural Regions</b> wall map. Ask the following questions:</p> <ul style="list-style-type: none"> <li>■ Which areas receive more than 80 inches of precipitation each year? (<i>The mountainous areas in the northern part of the state.</i>)</li> <li>■ Which areas receive less than 15 inches of precipitation each year? (<i>The inland valleys and deserts, especially in the southern part of the state.</i>)</li> <li>■ Which gets more annual precipitation, the northern half or the southern half of the state? (<i>The northern half of the state receives much more precipitation than the southern half.</i>) Tell students that nearly 70% of the precipitation in California occurs north of Sacramento. There is about eight times more precipitation on the Oregon border than there is on the Mexican border.</li> </ul>	<p><b>RI.5.3:</b> Explain the relationships or interactions between two or more...ideas, or concepts in a...scientific...text...</p>
<b>Step 4</b>	
<p>Remind students that California's topography influences precipitation patterns across the state. Tell them they will study how these precipitation patterns affect natural systems in California. Explain that a natural system includes all the living things in an area and their physical environment. Have students name some of the components of a natural system. (<i>Plants, animals, soil, temperature, and precipitation</i>)</p> <p>Ask students to name some of the natural systems found in California. (<i>Note: Students can refer to the <b>Natural Regions</b> wall map for help as needed. The natural regions are: Alpine Meadow, Low Desert, Scrubland and Chaparral, High Desert, Grasslands, Mixed Evergreen and Conifer Forest, Oak Woodland, North Coastal Forests [Redwoods], Sagebrush Scrub and Pinyon-Juniper Woodland, and Rivers and Lakes.</i>)</p>	<p><b>W.5.9:</b> Draw evidence from...informational texts to support analysis, reflection, and research.</p>
<b>Step 5</b>	
<p>Redistribute students' individual <b>Student Workbooks</b>. Tell them to turn to <b>Precipitation and Natural Regions in California</b> (Student Workbook, pages 10–11).</p> <p>Organize students into groups of three. Distribute a <b>Natural Regions</b> and <b>Precipitation in California</b> student map to each group. Ask groups to follow the instructions on <b>Precipitation and Natural Regions in California</b>. They should work together to compare the maps and answer the questions.</p>	<p><b>RI.5.3:</b> Explain the relationships or interactions between two or more...ideas, or concepts in a...scientific...text...</p> <p><b>W.5.2d:</b> Use precise language and domain-specific vocabulary to inform about or explain the topic.</p> <p><b>W.5.9:</b> Draw evidence from...informational texts to support analysis, reflection, and research.</p>

Procedures	Common Core Standards and Applications
<b>Step 6</b>	
<p>Explain that the amount of precipitation an area receives, and the area's temperature and type of soil, determine what kinds of plants and animals can live there. The amount and type of precipitation—rain or snow—influences the ecosystem found in any particular place.</p> <p>Gather student maps.</p> <p>Collect <b>Student Workbooks</b> and use <b>Precipitation and Natural Regions in California</b> for assessment.</p>	n/a

## Lesson 4: People Depend on Precipitation

Students study maps, graphs, and statistics to discover how water is used in California's human communities. They compare precipitation maps with water usage data, and learn that a huge water distribution network is necessary to support agricultural and urban development.



Use this correlation in place of the **Procedures** on pages 86–87 of the Teacher's Edition.

Procedures	Common Core Standards and Applications
<b>Vocabulary Development</b>	
Use the <b>Dictionary</b> and the vocabulary <b>Word Wall Cards</b> to introduce new words to students as appropriate.	<p><b>L.5.4c:</b> Consult reference materials...to...determine or clarify the precise meaning of key words and phrases...</p> <p><b>RI.5.4:</b> Determine the meaning of general academic and domain-specific words and phrases in a text...</p>
<b>Step 1</b>	
<p>Remind students that in the previous lesson they learned how precipitation patterns in California create a wide variety of natural regions across the state. In this lesson, they will learn how people in California rely on precipitation. Ask students, "How do you use water each day?" (<i>Water is used for drinking, washing, cooking, and other uses.</i>) Project <b>How We Use Water</b> (Visual Aid #12). Ask students to think about a typical day, and add to their list of ways they depend on water. Brainstorm for each category listed on the visual aid.</p> <p><b>Tip:</b> The brainstorm could be done as a whole class or with partners.</p>	<p><b>SL.5.1c:</b> Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.</p> <p><b>W.5.8:</b> Recall relevant information from experiences...; summarize or paraphrase information in notes and finished work...</p>
<b>Step 2</b>	
Project <b>How Precipitation Is Used in California</b> (Visual Aid #13). Ask students, "How much of the precipitation that falls in California is used for agriculture?" (17%) "How much of the precipitation is used in urban areas for homes, businesses, and industry?" (4%)	n/a
<b>Step 3</b>	
Emphasize the fact that the largest user of water in California is, by far, the agricultural industry. Studying maps and statistics will reveal why this is so. Redistribute students' individual <b>Student Workbooks</b> as well as colored pencils or crayons. Tell them to turn to <b>Agriculture in California</b> (Student Workbook, pages 12–14). Project <b>Average Annual Precipitation in California</b> (Visual Aid #11). Explain that they will need this map to complete <b>Agriculture in California</b> . Organize students into small groups. Have groups work together to read and complete <b>Agriculture in California</b> . Review as a class.	<p><b>RI.5.3:</b> Explain the relationships or interactions between two or more...ideas, or concepts in a...scientific...text...</p> <p><b>RI.5.7:</b> Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.</p> <p><b>W.5.9:</b> Draw evidence from...informational texts to support analysis, reflection, and research.</p>

Procedures	Common Core Standards and Applications
<b>Step 4</b>	
<p>Project <b>Natural Grasslands in the Central Valley</b> and <b>Agricultural Fields in the Central Valley</b> (Visual Aids #14–15). Ask students, “When it comes to water use, what do you think the difference is between the natural vegetation in the Central Valley, and vegetable and fruit crops in the Central Valley?” (<i>Grass and other grassland plants have adapted to the natural rainfall patterns in the valley, which is 5 to 20 inches per year, whereas fruit and vegetable crops need much more water.</i>) Tell students that most commercial growers of fruit and vegetable crops in California use irrigation systems such as the one on the transparency.</p>	<p><b>RI.5.3:</b> Explain the relationships or interactions between two or more...ideas, or concepts in a...scientific...text...</p>
<b>Step 5</b>	
<p>Project <b>Climatogram for Fresno</b> (Visual Aid #16). Use the <b>Word Wall Cards</b> to explain that a climatogram shows both the average monthly temperature and the average monthly precipitation for given areas. Tell students that Fresno County is one of the top agricultural counties in the state. Ask the following questions:</p> <ul style="list-style-type: none"> <li>■ When does it rain in Fresno? (<i>Most of the precipitation occurs between November and March.</i>)</li> <li>■ What are the average temperatures during these months? (<i>Daytime temperatures average from 40° F to 69° F.</i>) Tell students most crops grow better at warmer temperatures that exist during the dry months of the year. Many crops in California are grown on a year-round basis, even during the dry season, when there is very little rain. Demand for irrigation water increases during the dry summer months.</li> <li>■ Why is so much water needed for agriculture in California? (<i>Crops need a lot of water and are grown year-round in naturally dry areas.</i>)</li> </ul> <p><b>Tip:</b> Explain how to read a multiple-axis graph.</p>	<p><b>L.5.4c:</b> Consult reference materials...to...determine or clarify the precise meaning of key words and phrases...</p> <p><b>RI.5.1:</b> Quote accurately from a text when explaining what the text says explicitly...</p>
<b>Step 6</b>	
<p>Project <b>Population Centers in California</b> (Visual Aid #17) and <b>Average Annual Precipitation in California</b> (Visual Aids #11). While projecting the appropriate visual aid, discuss with students that the population centers are not located where most of the precipitation falls, by asking the following questions:</p> <ul style="list-style-type: none"> <li>■ Where does most of the precipitation fall in California? (<i>Most precipitation falls in the northern part of the state, along the northern coast and in the mountains.</i>)</li> <li>■ Where are the major population centers in California located? (<i>Most are in the southern half of the state, in the lowlands, valleys and deserts, where there is little precipitation.</i>)</li> </ul>	<p><b>RI.5.3:</b> Explain the relationships or interactions between two or more...ideas, or concepts in a...scientific...text...</p> <p><b>RI.5.7:</b> Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.</p>

Procedures	Common Core Standards and Applications
<b>Step 6 (Continued):</b>	
<ul style="list-style-type: none"> <li>How do you think the water gets from where it falls as precipitation to the urban centers where people need it? <i>(The precipitation flows into rivers or soaks into the ground. The water from precipitation flows into rivers and is carried to California's Water Projects, a huge network of dams, reservoirs, lakes, rivers, and aqueducts. The water projects help move the water to cities, among other uses.)</i></li> </ul>	<p><b>RI.5.3:</b> Explain the relationships or interactions between two or more...ideas, or concepts in a...scientific...text...</p> <p><b>RI.5.7:</b> Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.</p>
<b>Step 7</b>	
<p>Project <b>California's Water Projects</b> (Visual Aid Aid #18) and explain that this map identifies California water projects that help move water from where it falls as precipitation to places where people have agricultural and urban uses for it. Snowpack in the mountains serves as a natural reservoir, releasing water into streams and rivers between May and July. Precipitation flows into rivers, and California water projects—including dams, reservoirs, and aqueducts—store and move the water from rivers and reservoirs to agricultural areas and cities. Emphasize that most of the water projects were built between the 1930s and 1970s (although construction of new facilities continues) and made agriculture and urban development possible in the southern part of the state. Help students locate and identify California water projects that help provide water to their communities.</p>	n/a
<b>Step 8</b>	
<p>Tell students to turn to <b>Using Sierra Nevada Water</b> (Student Workbook, page 15). Ask students to use pictures, words, symbols, or a combination, to create a simple diagram that shows how people throughout California use water that first falls as precipitation in the Sierra Nevada. The diagram should show different water users (homes, businesses, and industry) and illustrate how precipitation in the Sierra Nevada is connected to people on farms and in urban areas.</p> <p>Collect <b>Student Workbooks</b> and use <b>Agriculture in California</b> and <b>Using Sierra Nevada Water</b> for assessment.</p>	<p><b>SL.5.4:</b> Report on a topic or text..., sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main idea or themes...</p> <p><b>SL.5.5:</b> Include multimedia components...and visual displays in presentations when appropriate to enhance the development of main ideas or themes.</p> <p><b>Suggestion:</b> <i>Students can present their drawings and describe how they answer the questions. Drawings could be done by hand or digitally using Powerpoint or other presentation software.</i></p>

## Lesson 5: Human Activities and Water Quality

Students conduct experiments to discover what happens when they expose plants and chalk to acidified water. Students learn how acid rain forms and study its damaging effects. They list human activities that cause acid rain, and they suggest alternative actions to cut acid rain production.



Use this correlation in place of the **Procedures** on pages 104–105 of the Teacher's Edition.

Procedures	Common Core Standards and Applications
<b>Vocabulary Development</b>	
Use the <b>Dictionary</b> and the vocabulary <b>Word Wall Cards</b> to introduce new words to students as appropriate.	<p><b>L.5.4c:</b> Consult reference materials...to...determine or clarify the precise meaning of key words and phrases...</p> <p><b>RI.5.4:</b> Determine the meaning of general academic and domain-specific words and phrases in a text...</p>
<b>Step 1</b>	
Tell students that in this lesson, they will learn about changes that human activities can make in the chemical characteristics of precipitation. Write the term “acid precipitation” on the board. Ask students, “What is a characteristic of an acid?” ( <i>It is a substance with a sour taste.</i> ) “What are some examples of liquids that are acidic?” ( <i>Vinegar, the citric acid in lemons, and other citrus fruits are acidic.</i> ) Explain that acid rain is any kind of precipitation that has become more acidic than normal precipitation. Emphasize that “acid rain” and “acid precipitation” are terms often used to mean the same thing. Both refer to acidic rain as well as other forms of precipitation (snow, hail, and sleet).	<p><b>RI.5.4:</b> Determine the meaning of general academic and domain-specific words and phrases in a text...</p>
<b>Step 2</b>	
Tell students that they are going to conduct some experiments to see what happens to aquatic plants and chalk in acidic water. Redistribute students’ individual <b>Student Workbooks</b> . Tell them to turn to <b>Effects of Acidic Water</b> (Student Workbook, pages 16–18). Organize students into groups of four and distribute the activity supplies for the experiment. Read the “What to do” section for both Parts 1 and 2 of <b>Effects of Acidic Water</b> , and have students record their observations of the chalk and plants. Have students set up and conduct the experiment according to the instructions. ( <i>Note: The effects of acidic water on chalk will vary depending on the chemical composition of the chalk. Some reactions are vigorous; others will require an overnight waiting period to observe significant evidence of a reaction. The effects of acidic water on plants will be apparent after the plants are in the vinegar solutions overnight. It is recommended that you wait until the next day before continuing on to Step 3, so that students can see the results of their experiments. Students may wish to study the effects for a few more days; acidic water’s effects on aquatic plants become more severe over time.</i> )	<p><b>W.5.2d:</b> Use precise language and domain-specific vocabulary to inform about or explain the topic.</p> <p><b>W.5.8:</b> Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes or finished work...</p>

Procedures	Common Core Standards and Applications
<b>Step 2 (Continued):</b>	
When students have completed the experiments, have them work as a group to record their observations and answer the questions on page 3 of <b>Effects of Acidic Water</b> . Discuss their results and the answers to the questions as a class.	<p><b>W.5.2d:</b> Use precise language and domain-specific vocabulary to inform about or explain the topic.</p> <p><b>W.5.8:</b> Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes or finished work...</p>
<b>Step 3</b>	
Ask students, "Given what happened to the plant in our experiment, what effects do you think acid rain might have on plants and other living things?" ( <i>Acid rain can make soils, lakes, and streams very acidic, which can damage plant and animal life.</i> ) Explain that acid rain has caused many lakes and streams in the northeastern United States to become more acidic than normal. When acid rain drains into lakes, it kills off the tiny plant and animal life floating in the water. Many kinds of fish eggs become unable to hatch. The lakes can no longer support fish, frogs, and salamanders. Because their food sources are gone, animals such as otters, osprey, and loons have also left the area. The lakes look clear and clean, but are too acidic to support plant and animal life. Over time, acid rain can also kill trees.	<b>SL.5.1d:</b> Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions.
<b>Step 4</b>	
Ask students, "Given what happened to the chalk in our experiment, what effects do you think acid rain might have on structures, such as statues and buildings?" ( <i>Acid rain can dissolve some materials used to make statues and buildings, such as limestone and marble.</i> ) Project <b>Statue Damaged by Acid Rain</b> (Visual Aid #19). Ask students, "How has this statue changed over the years?" ( <i>The details, such as the facial features, have been eaten away.</i> ) Tell students that acid rain is responsible for the corrosion shown in the image.	<b>SL.5.1d:</b> Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions.
<b>Step 5</b>	
Project <b>What Causes Acid Rain?</b> (Visual Aid #20). Explain that acid rain is caused by a chemical reaction that begins when certain chemicals are released into the air. Most of these chemicals are released when fossil fuels, such as coal, oil, and gasoline, are burned. These chemicals can rise very high into the air, where they mix and react with water, oxygen, and other chemicals to form acid water droplets. The water droplets that make up clouds become acidic. These acidic clouds can be carried far by the wind. As a result, acid rain can fall far from the source of the pollution, sometimes thousands of miles away.	n/a

Procedures	Common Core Standards and Applications
<b>Step 6</b>	
Project <b>Coal-Burning Power Plant</b> (Visual Aid #21). Explain that coal-burning power plants are the biggest source of the chemicals that produce acid rain. Most of the coal-burning power plants in the United States are in the eastern part of the country. Therefore, the most severe problems caused by acid rain are also in the eastern states. Project <b>Motor Vehicles</b> (Visual Aid #22). Explain that cars, trucks, and buses release chemicals into the air that cause acid rain when they burn fuel. In California, acid rain can cause problems, such as corrosion of human structures, especially where there is heavy traffic in urban areas. Acid precipitation can kill off trees and harm natural systems.	n/a
<b>Step 7</b>	
Tell students to turn to <b>Acid Rain—Past, Present, and Future</b> (Student Workbook, pages 19–21). Have students read about the history of acid rain. Ask each student to prepare a question for the other students in their group. They should base their question on the reading or other information presented in the lesson. In their groups, have students take turns asking their question and briefly discussing the answer. Ask students to record the four questions and their answers on their copy of <b>Acid Rain—Past, Present, and Future</b> .	<p><b>R.5.10:</b> ...read and comprehend informational texts, including...science...texts...</p> <p><b>SL.5.1c:</b> Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.</p>
<b>Step 8</b>	
<p>Explain that human activities can affect the chemical makeup of precipitation. As a class, brainstorm human activities that contribute to acid precipitation. Remind students that any activity that requires burning fossil fuels at any time in its history (processing raw materials, manufacturing products, transporting people and products, purchasing and using products) produces some chemicals that create acid precipitation. List their ideas on the board. (<i>Activities will vary but could include riding in a car, purchasing foods transported by truck from another area, heating homes, and using electrical appliances.</i>) For each activity listed, ask whether students can think of ways to minimize the effects. (<i>Carpooling, taking public transportation, walking, riding a bike, purchasing locally grown produce from a farmers' market or grocery store, turning down the heat to save energy, and buying and using energy-efficient appliances are just some possibilities.</i>)</p> <p>Collect <b>Student Workbooks</b> and use <b>Effects of Acidic Water</b> and <b>Acid Rain—Past, Present, and Future</b> for assessment.</p>	<p><b>SL.5.3:</b> Summarize the points a speaker...makes and explain how each claim is supported by reasons and evidence...</p> <p><b>W.5.2d:</b> Use precise language and domain-specific vocabulary to inform about or explain the topic.</p> <p><b>W.5.8:</b> Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes or finished work...</p>

## Lesson 6: Effects of Human Activities on the Quantity and Distribution of Precipitation

Students learn about urban heat islands and examine evidence indicating that precipitation around cities in warm, moist climates is increasing. They also consider evidence that aerosols in dry climates cause a decrease in precipitation. Finally, they revisit the Sierra Nevada and explore the changing precipitation patterns there.



Use this correlation in place of the **Procedures** on pages 122–124 of the Teacher's Edition.

Procedures	Common Core Standards and Applications
<b>Vocabulary Development</b>	
Use the <b>Dictionary</b> and the vocabulary <b>Word Wall Cards</b> to introduce new words to students as appropriate.	<p><b>L.5.4c:</b> Consult reference materials...to...determine or clarify the precise meaning of key words and phrases...</p> <p><b>RI.5.4:</b> Determine the meaning of general academic and domain-specific words and phrases in a text...</p>
<b>Step 1</b>	
Remind students that in the last lesson they learned that human activities, such as burning fossil fuels like coal and gasoline, can put chemicals in the air that increase the acidity of precipitation. In this lesson, they will learn that scientists are gathering evidence that indicates human activities are also changing precipitation patterns.	n/a
<b>Step 2</b>	
<p>Ask students to recall the cloud formation demonstration during Lesson 2 that showed how clouds form. Ask students, “What three things are needed for clouds and rain to form?” (<i>Clouds and rain need water vapor in the air, a drop in air temperature, and surfaces, such as dust particles floating in the air, or aerosols, on which water vapor can condense.</i>) Explain that a change in any one of these three things could change the number of clouds that form and the precipitation that falls in an area. Discuss changes in water vapor by asking the following questions:</p> <ul style="list-style-type: none"> <li>■ What would happen if the amount of water vapor in the air increased? Would the amount of precipitation increase or decrease? (<i>Increase</i>)</li> <li>■ What would happen if the amount of water vapor in the air decreased? Would the amount of precipitation increase or decrease? (<i>Decrease</i>)</li> <li>■ How might human activities change the amount of water vapor in the air? (<i>Accept all reasonable answers. For example, in dry climates where fields or lawns are irrigated there may be an increase in humidity, along with an increase in cloud formation and precipitation.</i>)</li> </ul>	<p><b>W.5.8:</b> Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work...</p>

Procedures	Common Core Standards and Applications
<b>Step 3</b>	
<p>Explain that human activities can also influence the third requirement for cloud formation and precipitation: the number of aerosols in the air. For example, some forms of air pollution increase the number of aerosols in the air. These include vehicle exhaust, dust from construction, agriculture and development, and smoke from industry. The heavy traffic in urban areas means that air in urban areas has more aerosols than air in the surrounding countryside does.</p>	n/a
<b>Step 4</b>	
<p>Ask the following questions to explore ways in which human activities can cause changes in air temperature:</p> <ul style="list-style-type: none"> <li>■ Imagine a hot, sunny day. Which clothing would make you feel warmer, a black t-shirt or a white t-shirt? <i>(The black t-shirt would be warmer.)</i></li> <li>■ Imagine an asphalt parking lot on a hot, sunny day. Would you be able to walk barefoot on the asphalt? <i>(No, it would burn your feet.)</i></li> <li>■ Would you be able to walk barefoot on grass on a hot, sunny day? <i>(Yes, because it does not absorb and hold heat like asphalt does.)</i></li> <li>■ Which do you think are usually warmer, urban areas or the surrounding countryside? <i>(Urban areas have higher concentrations of buildings, roads, and other artificial surfaces that retain heat and produce warmer surrounding temperatures.)</i></li> <li>■ Why are urban areas usually warmer than the surrounding countryside? <i>(Urban areas have higher concentrations of buildings, roads, and other artificial surfaces that retain heat and produce warmer surrounding temperatures.)</i></li> </ul> <p>Use the paper spiral described in <b>Hot Air Demonstration</b> (Teacher's Masters, page 2) to show students how a paper spiral spins when held over a heat source.</p> <p>Ask the following questions:</p> <ul style="list-style-type: none"> <li>■ Why does the paper spiral spin? <i>(The lamp heats the air. The warm air expands, making it less dense than cool air, so it rises. This makes the spiral turn.)</i></li> <li>■ What happens when warm air rises? <i>(It cools, and water vapor in it condenses to form clouds.)</i> What human activities might contribute to warmer air temperatures in urban areas? <i>(Building roads and buildings that absorb heat, or removing natural vegetation might contribute to the problem.)</i></li> </ul>	<p><b>W.5.8:</b> Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work...</p>

Procedures	Common Core Standards and Applications
<b>Step 5</b>	
Project <b>Urban Heat Islands</b> (Visual Aid #23) by explaining that a city that is warmer than the surrounding countryside is called an urban heat island. Use the diagram to show how cities generate and trap heat. Point out the arrows that indicate that hot air rises. Show how cooler air from the surrounding countryside is sucked in to replace the rising warm air. Ask students, "How do you think urban heat islands can change precipitation patterns?" ( <i>If the air is humid, there will be more rising hot air over urban heat islands, and more clouds and precipitation will form.</i> )	<b>RI.5.7:</b> Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.
<b>Step 6</b>	
<p>Explain that since the 1990s, NASA scientists have been using a satellite to study rainfall patterns around urban areas. They want to find out if, in fact, urban heat islands cause increased precipitation around cities. Project <b>Precipitation Patterns in Texas</b> (Visual Aid #24). Explain that the image shows data collected by a NASA satellite. Explain that the blue areas indicate where there was more rain than usual. Have students study the image, and conduct a discussion by asking the following questions:</p> <ul style="list-style-type: none"> <li>■ What do you notice about precipitation patterns around Texas? (<i>Precipitation was greater to the east of the major cities.</i>)</li> <li>■ Winds in Texas usually blow from west to east. Was there more precipitation upwind or downwind from cities in Texas? (<i>Downwind</i>)</li> <li>■ Does this data support scientists' predictions that urban heat islands increase the amount of precipitation around cities? (<i>Yes, the clouds formed over cities, and the wind carried them eastward before they released precipitation.</i>)</li> </ul>	<b>RI.5.7:</b> Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.
<b>Step 7</b>	
Explain that the story of how urban heat islands change precipitation patterns is more complicated. Scientists believe other factors besides rising hot air around cities can affect precipitation patterns. Around urban areas in California, precipitation is decreasing. Ask students, "What if there was an increase in aerosols in a drier climate? How might that change precipitation patterns?" ( <i>The limited amount of water vapor in the air would condense on the increased number of aerosols. Since there are more aerosols, the individual water droplets may not get big enough to fall as precipitation.</i> )	<b>RI.5.3:</b> Explain the relationships or interactions between two or more...events, ideas, or concepts in a...scientific...text based on specific information in the text.

Procedures	Common Core Standards and Applications
<b>Step 8</b>	
Project <b>How Cities May Be Changing Precipitation Patterns</b> (Visual Aid #25). Explain that scientists think that as the cities along the southern coast of California grew, there was an increase in pollution and in the number of aerosols in the air. Because the climate along the coast is dry, the higher number of aerosols means there are more particles around which cloud droplets can form. Because there are more particles and the same amount of water vapor, the cloud droplets are smaller. They do not get big enough to form water drops large enough to fall as rain. As a result, precipitation downwind (and upslope) of coastal cities may have decreased due to air pollution.	<p><b>SL.5.3:</b> Summarize the points a speaker...makes and explain how each claim is supported by reason and evidence.</p> <p><b>Suggestion:</b> Have students stop periodically to paraphrase the information that the teacher is presenting.</p>
<b>Step 9</b>	
Explain that scientists have discovered that precipitation upslope and downwind of California's urban areas has decreased by 20% over the last 100 years. Precipitation downwind of rural areas has not changed. This is convincing evidence that cities are changing precipitation patterns, but scientists do not know for sure. They need to do much more research to understand the effects of urban pollution on precipitation patterns in California.	n/a
<b>Step 10</b>	
<p>Tell students that human activities are changing precipitation patterns in other ways, as well. Ask students to recall what they learned about the effect of a warming climate by reading <b>California Connections: The Sierra Snowpack</b> (Student Workbook, pages 2–5). Ask the following questions:</p> <ul style="list-style-type: none"> <li>■ Why is the climate warming in the Sierra Nevada? (<i>People burn fossil fuels, such as gasoline. That sends more of certain gases, such as carbon dioxide, into the atmosphere, where the gases trap more heat.</i>)</li> <li>■ How does the warming climate affect precipitation patterns? (<i>Warmer air is causing snow to melt, or not to fall at all. It snows less, and the snow melts more quickly in warmer weather.</i>)</li> </ul>	<p><b>RI.5.3:</b> Explain the relationships or interactions between two or more...events, ideas, or concepts in a...scientific..text based on specific information in the text.</p> <p><b>RI.5.7:</b> Draw on information from...print or digital sources, demonstrating the ability to locate an answer to a question...</p> <p><b>RI.5.10:</b> ...read and comprehend informational texts, including...science...texts...</p> <p><b>W.5.8:</b> Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work...</p>
<b>Step 11</b>	
Explain that these changes in temperature and precipitation are occurring all over the world, not just in California. Scientists have analyzed temperature data in cities and towns across the United States. Temperatures were above normal almost everywhere during the last 10 years. The 10 warmest years of the global historical record have all occurred since 1990.	n/a
<b>Step 12</b>	
Project <b>Lyell Glacier, California</b> (Visual Aid #26). Explain that Lyell Glacier is in Yosemite National Park. The two photographs show the glacier in 1903 and 100 years later, in 2003. Ask students, "What differences do you see between these two photographs?" ( <i>The glacier has retreated.</i> ) Explain that retreating glaciers all over the world are one of the consequences of global climate change.	<p><b>SL.5.3:</b> Summarize the points a speaker...makes and explain how each claim is supported by reason and evidence.</p> <p><b>Suggestion:</b> Have students stop periodically to paraphrase the information that the teacher is presenting.</p>

Procedures	Common Core Standards and Applications
<b>Step 13</b>	
<p>Redistribute students' individual <b>Student Workbooks</b>. Tell them to turn to <b>How Humans Are Changing Precipitation</b> (Student Workbook, page 22).</p> <p>Collect <b>Student Workbooks</b> and use <b>How Humans Are Changing Precipitation</b> for assessment.</p>	<p><b>W.5.2:</b> Write informative/explanatory texts...</p> <p>b) Develop the topic with facts, definitions, concrete details, ...or other information and examples related to the topic.</p> <p>d) Use precise language and domain-specific vocabulary to inform about or explain the topic.</p> <p><b>W.5.8:</b> Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes or finished work...</p>

## Unit Assessment

Refer to the introduction pages at the front of this document for information regarding the Traditional and Alternative Assessments for this unit and their Common Core correlations.

### California Common Core State Standards Descriptions

#### Language Standards

- **L.5.4:** Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on *grade 5 reading and content*, choosing flexibly from a range of strategies.
  - c) Consult reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation and determine or clarify the precise meaning of key words and phrases **and to identify alternate word choices in all content areas. CA**
- **L.5.6:** Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases, including those that signal contrast, addition, and other logical relationships (e.g., *however, although, nevertheless, similarly, moreover, in addition*).

#### Reading Standards for Informational Text

- **RI.5.1:** Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.
- **RI.5.3:** Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.
- **RI.5.4:** Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a *grade 5 topic or subject area. (See grade 5 Language standards 4–6 for additional expectations.) CA*
- **RI.5.7:** Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.
- **RI.5.10:** By the end of the year, read and comprehend informational texts, including history/social studies, science, and technical texts, at the high end of the grades 4–5 text complexity band independently and proficiently.

#### Speaking and Listening Standards

- **SL.5.1:** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 5 topics and texts*, building on others' ideas and expressing their own clearly.
  - c) Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.
  - d) Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions.
- **SL.5.2:** Summarize a written text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.
- **SL.5.3:** Summarize the points a speaker **or media source** makes and explain how each claim is supported by reasons and evidence, **and identify and analyze any logical fallacies. CA**
- **SL.5.4:** Report on a topic or text or present an opinion, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.
- **SL.5.5:** Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.

#### Writing Standards

- **W.5.2:** Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
  - b) Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic.
  - d) Use precise language and domain-specific vocabulary to inform about or explain the topic.
- **W.5.8:** Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.
- **W.5.9:** Draw evidence from literary or informational texts to support analysis, reflection, and research.